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# Innovation and Risk Management – A Cute Couple or Opposing Forces?

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**Abstract:** Creating new service innovations has been a popular topic in the scientific literature as the importance of service value production has been identified in the recent decade or so. Fuzzy Front End innovation process is used to create new service innovations but it has often proven as a complex process with high uncertainty. The integration of risk management and innovation management processes has been little discussed subject in the scientific literature, however there can be seen clear benefits in this. In this research we utilize scientometrics to illustrate the lack of research that takes into account the risk management perspective in innovations. Furthermore, we propose an integrated model by synthesising the double diamond service development model with innovation management and risk management.

**Keywords:** Innovation Management, Risk Management, Fuzzy Front End Innovation, Service Innovation, Double Diamond, Scientometrics

## 1 Introduction

Services are becoming one the most important areas to produce value and there is a high demand for service innovations (Tether and Hipp, 2002). However, service networks are highly vulnerable to risks and thus can be challenging environment for innovation management. Although the importance of service networks has been identified and discussed by several scholars, the specifics of their management have been addressed by relatively few (e.g. Ellram et al., 2007). The current studies have focused mainly on applying the existing traditional manufacturing supply chain models to the service context, while only a few have developed new frameworks for service network management (e.g. Baltacioglu et al., 2007, Vilko and Ritala, 2014).

As the importance of networks and ecosystems is rising, and the competition between the networks is getting tougher, both innovation and risk management can be used to

improve the productivity and resilience of the service systems (Teece, 2010). Innovation practises can be used to improve the understanding of the nature of complex service networks, and to help develop new practises which enable proper management of risks. Innovation can enable finding new insights to find more effective ways to implement risk management in service network context.

By nature the management of risk and innovation can appear to have similar characteristics but on the other hand they can be considered as opposing forces. Importantly, the extensive risk management procedures could reduce the failure possibilities, while too comprehensive risk procedures could slow down and stifle innovation. As a result it has been argued that innovation and uncertainty, which is closely related to risks are inseparable (Adams, Bessant, and Phelps 2006; Wong and Chin 2007). Furthermore, how organizations view and react to risks will evidently impact on the innovation-related decision-making throughout various stage of innovation process (Meijer et al. 2006). As a rule of thumb a good innovation and risk management process should identify risks as soon as possible and take required actions to manage the risks. Since a great majority of new ideas will never turn to innovation, the failure due realization of the risk is the most likely outcome of any innovation process. There are only few studies which have tried to combine risk and innovation management frameworks (Bowers and Khorakian, 2014). Therefore, in this study we focus on the roles of innovation and risk management especially in the fuzzy front end of service innovation context.

## 2 The Fuzzy Front End of Service Innovation

### *2.1 Fuzzy Front End of Innovation*

Many innovation process models and related management practices have been suggested, which typically cover various stages from the idea generation to implementation. The fuzzy front end of innovation (later FFE), a term coined by Smith and Reinertsen (1991) is attributed to the early phase of the innovation process (Cooper, 1988) and typically includes stages from the idea generation to decisions on further development, which most often takes place within a project (Nobelius and Trygg, 2002, Jetter, 2003). Interestingly, the existing FFE literature has mainly focused on the idea generation, whereas studies regarding idea selection (also known as idea screening process, Toubia and Florès, 2007), is significantly less representative (Girotra et al. 2010). However, selecting the best ideas for further development while at the same time notifying the risks is critical for business success, since a great majority of whole life cycle costs and features will be defined at the FFE stage (Wagner and Ehrenmann 2010). Since only limited amount of information is available during the FFE stage, the decision making qualifications are most likely more uncertain, than in later stages of innovation process (Zhang and Doll 2001; Koen, 2001).

In prior studies, a comprehensive set of various systematical criteria, guidelines and tools have been proposed to improve FFE decision making processes (Hammedi et al. 2011; Riedl, et al. 2010). Go/no-go decision points are among the key points for managing risk during the innovation process, since they are formally assessing the quality of the idea and making sure that organization is doing the right things (Carbonell-Foulquié et al. 2004). Decisions in these points include following two error sources which have direct influence

on the risk management (Hammedi et al. 2011). In Type I error, resources are allocated to inappropriate projects, while in Type II error good ideas which have a potential to become successful innovation are neglected. A successful innovation and risk management process should minimize the both error types. Even if there are FFE studies which have focused on the selection criteria definition (Carbonell-Foulquié et al. 2004; Cooper, 2001), team based decision making in various settings (Faure, 2004; Rietzschel et al. 2006; Onarheim and Christensen, 2012) and how an individual person is making decisions at the FFE (Ritter et al. 2012, Santonen and Hytönen, 2015) in practice organizations are still facing many challenges when managing their FFE processes.

### *2.2 Iterative Service Design process*

Service design (SD) which is close relative to Design Thinking (DT) (Simonds, 2016) has become a central framework used within many organizations to innovate services. It is about planning, developing and innovating services through specific iterative service development processes. SD brings new methods, techniques and tools to improve, innovate, and visualise the service offering, processes, and organization. The purpose of SD is to create a customer-centric service experience that meets the needs and demands of the customers and fulfils the service provider's business objectives. Through a SD approach, diverse teams can collaboratively identify needs, ideas, experiences and opportunities and generate fast prototypes to be tested by the real users and customers. SD helps to innovate (create new) or improve (existing) services to make them more useful, usable, desirable for customers and efficient as well as effective for the organization.

Tschimmel (2012) has reviewed five well-known models of the Design Thinking process and argued that *"most of these models describe the Design Thinking process as a "system of overlapping spaces" (Brown & Wyatt, 2010: 33) and as an iterative process (Stickdorn & Schneider, 2010: 122)"*. Iterative agile development is also known as a spiral model development which is enabling flexibility and risks controlling. In practice a spiral model development and enhancement (Boehm, 1988) and Agile Development which most often is applied in software development is a set of development methods in which requirements and solutions evolve through multiple iterative collaboration rounds between cross-functional teams and end-users. It promotes adaptive planning, evolutionary development, early delivery, continuous improvement, and encourages rapid and flexible response to change. Therefore, it fits well also with above described SD and DT approach which also aims to accomplish fast prototyping and solutions development.

In this study we apply our combined service design innovation and risk management model to the Double Diamond Model (also known as 4 D) which was initiated by the British Design Council in 2005. The Double Diamond Model includes Discover, Define, Develop and Deliver stages (a.k.a The 4 D's). The first *Discovery phase* focuses on searching new opportunities by gathering various kinds of information and insights. In the second *Definition stage* the aim is to make sense of the identified possibilities while framing the scope for the business challenge. The insights collected in the first phase, are reviewed and selected for further development, rejection or returning in previous stage. In the third *Development stage*, solutions or concepts are created, prototyped, tested and iterated. According to the definition of the fuzzy front end of innovation (later FFE), the development stage can be interpret not to include any more in FFE. However, in our opinion if the financial investments and required resources are minor, in these cases this

stage could also be included in FFE. In the final *Deliver stage*, the development project results are finalised and launched.

## 3 Evaluating popularity of integrated innovation and risk management studies

### *3.1 Research design*

In this study we aim to develop an integrated framework which combines innovation and risk management theories into a single holistic concept especially for the Fuzzy Front End of Innovation stage. Our research design is two-folded.

*First*, we are empirically verifying the popularity and the covered viewpoints relating the studies which are combining the innovation management and risk management viewpoints. Recently, Santonen and Conn (2015) illustrated a comprehensive framework for classifying various types and combinations of scientometric studies when studying actors and/or contents within a particular research theme. The suggested framework includes three main viewpoints for conducting analysis. However, in this study we are only covering *"Popularity-based viewpoint"* (Choi et al, 2011) in order to analyse descriptive profiles and distributions of the combined "innovation management" and "risk management" studies.

Second, after verifying coverage of the suggested topic, we identify the key attributes and elements which are required to build up the combined innovation management and risk management framework.

### *3.2 Data collection and construction of key measures*

Triangulation is derived from navigation and military strategies (Smith, 1975:273) and in short can be defined as (Denzin 1978, p. 291) "the combination of methodologies in the study of the same phenomenon". There are many possible approaches for triangulation including the data triangulation –gathering data at different data sources. It has been argued that Scopus has more extensive coverage than ISI Web of Science (WoS) (Falagas et al. 2008). Therefore, the data for evaluating the existence and popularity of innovation management and risk management studies was collected from both of these databases in order to increase the robustness of our data collection and reveal possible differences between these given databases. Furthermore, some studies suggest that Google Scholar could be used as an alternative or complementary resource to the Scopus and WoS since it has better coverage of conference proceedings (Meho and Yang 2007) and the management studies (Harzing and Van Der Wal, 2009 ; Mingers and Lipitakis, 2010). Since "innovation management" and "risk management" studies are most typically conducted by management scholars, it is possible that WoS and Scopus are not fully able to detect the emerging research trends as good as the more extensive Google Scholar regardless the known weakness of the Google Scholar (Falagas et. al. 2008; Aguillo, 2011; De Winter et. al 2014).

In the case of WoS topic search (search from title, abstract, author keywords and keywords plus which consist of words and phrases harvested from the titles of the cited articles) and in the case of Scopus (title, abstract or keywords) was applied. Google Scholar provides only the following two options: "only in title" or "anywhere in article". Therefore,

the absolute number of publications are not directly comparable with Scopus and WoS, but the relative frequency comparison within Google Scholar results could be compared to relative Scopus and WoS findings.

The unit of analysis in this study is a scientific publication which topically focuses on "Innovation management" and "Risk management". In order to reveal all the relevant "Innovation management" and "Risk management" contributions, the search criteria were based on following combinations. *First*, the "Innovation management" (IM) search term will reveal all the innovation management studies whereas independent "Risk management" (RM) will reveal all the risk management studies. The combined search "IM + RM" term is used to identify the studies which are covering the both management practices. Since "IM" study could cover also risk viewpoint, the additional search including "IM + R" search terms was applied as well as "RM + I" combination.

### *3.3 Results: Popularity of studies focusing on Innovation Management and Risk Management*

In Table 1 comparison between cumulative number of publications in Scopus, WoS and Google Scholar is presented for all our search terms. In Table 2 the relative popularity of Innovation Management studies having risk focus and Risk Management studies having innovation focus are compared.

**Table 1** Popularity comparison (cumulative) between Innovation Management (IM) and Risk Management (RM) studies.

| *Search Terms* | *Scopus 1 Title, Abstract, Keywords* | *Scopus 2 All fields* | *WoS Topic* | *Google Scholar 1 Title* | *Google Scholar 2 All* |
|---|---|---|---|---|---|
| IM | 3.403 | 63.549 | 2.274 | 5.150 | 398.000 |
| RM | 98.118 | 253.940 | 35.168 | 72.300 | 1.540.000 |
| IM + R | 234 | 15.063 | 143 | 33 | 182.000 |
| RM + I | 2.291 | 26.845 | 823 | 97 | 314.000 |
| IM + RM | 50 | 2.573 | 28 | 32 | 16.900 |

**Table 2** Relative popularity of Innovation Management (IM) studies having risk focus and Risk Management (RM) studies having innovation focus.

| *Search Terms* | *Scopus 1* | *Scopus 2* | *WoS* | *Google Scholar 1* | *Google Scholar 2* |
|---|---|---|---|---|---|
| A = RM + I / RM | 2.3 % | 10.6 % | 2.3 % | 0.1 % | 20.4 % |
| B = IM + R / IM | 6.9 % | 23.7 % | 6.3 % | 0.6 % | 45.7 % |
| A / B | 34.0 % | 44.6 % | 37.2 % | 20.9 % | 44.6 % |

As presented in Table 1, there are only a handful of prior studies which have focused the integrated innovation and risk management framework. In scientific publication title, abstract and/or keywords should capture the essence of the publication. Therefore, if the innovation and risk management related search terms are not found in them, then the main scope of the paper does not include these particular topic(s). A bit surprisingly for us, the

amount of integrated innovation and risk management studies remained extremely low (Scopus 50, WoS 28 and Google 32) when using title, abstract and keywords as search fields. Furthermore, the innovation management studies having a at least some kind of risk focus (IM + R) have had also relative limited popularity (Scopus having most publications, 234). Risk management studies having innovation focus are clearly more popular due the fact that risk management studies in general are more popular than innovation management studies. The relative comparison of RM + I / RM studies reveals that in all innovation focus in management studies are minor (in Scopus and WoS about 2.3 %) whereas risk focus in innovation management studies is a bit more popular (in Scopus 6.9% and WoS about 6.3 %). However, the absolute number of studies favours taking risk management as a starting point for our integrated model and therefore in the following we define the key attributes for our model from risk management literature.

## 4 Constructing the integrated innovation and risk management model

### *4.1 Different way to define risks in various domains*

Due to its complex and multifilament nature, risk has received many different conceptualizations in different scientific literatures. In the finance literature has typically viewed risks is in terms of probabilities of expected outcomes (Beaver 1966). This view to risk is one of the oldest one known and it was used for insuring merchant ships since many centuries ago. The strategy literature views risk from the perspective of adjusted rates of capital return on investment variability of expected and actual returns (Bettis 1981), risk of strategic actions, and relational risks (such as opportunism, cheating or stealing customers) (Baird & Thomas 1985). Marketing literatures perspective to risk is related to the nature of the field such as purchasing behaviour, meeting psychological, and performance goals (Cox 1967). In a supply chain context, risk is defined as a threat that something might happen to disrupt normal activities, which stops things happening as planned (Waters, 2009).

The capability to manage risks is considered to be dependent on ability to measure risk impact in a quantifiable manner. The ability to measure risk is based on the likelihood of the event occurring and the consequence derived from such event. Accordingly, Mitchell (1995) defined a risk formula based on risks likelihood and impact as follows:

RISK = PROBABILITY X IMPACT.

### *4.3 Risk Management in Innovation Management*

As presented in section 3, in innovation management, risk has received only limited attention, and the definition of risk has been linked to the view that risk arises from the effect of uncertainty on objectives (Aven 2012). In doing this, innovation perspective to risk has been argued not to be defined in terms of probabilities (da Silva Etges & Cortimiglia, 2017; Aven 2012), which is the most common mean in business context, but rather in terms of uncertainty which can have different natures and levels of intensity and cannot necessarily be fully eliminated by gathering more information (da Silva Etges & Cortimiglia, 2017; Meijer et al., 2006). As a solution for this, we use the uncertainty framework proposed by Vilko et al. (2014) where risk refers to the propabilistic certainty

of possibilities (of likelihood and impact of an event). Thus risk concept is considered one level of uncertainty and the function of risk management is responsible of managing all types of uncertainties. Therefore risk can defined as the implication of a phenomenon or the object of the phenomenon being uncertain (Diekmann et al., 1989). The main difference between these concepts is thus that risk is a quantifiable measure for future events what uncertainty is necessarily not (Waters, 2009).

Liu and Wang (2008) proposed a risk assessment tool based on decision criteria in a fuzzy environment, where the indicators for risk are categorised into two groups: internal and external. Internal risk relates to cooperative risk, management decision risk, information sharing risk, operation schedule risk, financial risk, and human resource risk. External risk includes political risk, economic risk, technology risk, market risk, and nature hazard. In this case, a typical fuzzy multi-criteria decision-making problem is set in a matrix with partial weight of some indicators based on judgement from data collection. Similarly, for our purpose we will utilise the risk management perspective in for the FFE innovation management indicators to create more comprehensive understanding of the uncertainty related to the service innovation.

### *4.4 Integrated Innovation and Risk Management Process for Fuzzy Front of Service Innovation*

Risk management is generally considered to comprise three main steps, namely identification, analysis and control, according to which we build our management process of risks which we proposes three step planning process for proactive protection against risks:. Based on this we build our proposition.

The model illustrated in the Figure below takes is a synthesis of double diamond service model that explicitly takes into account the innovation and risk management perspectives. The model starts from the unstructured themes of which are identified in the first step from the two perspectives (innovation and risk). This, discovery-phase of the double diamond model, searches new elements where innovation aims to identify the value and risk management the costs and risks elements related to those.

The second step of the model includes the analysis of the identified elements (define phase of the model) where the innovation management assess of the potential positive value (benefits) of the elements while risk management takes into accounts the negative value factors (namely costs and risks) elements.

Finally, the third steps of the model is the management action where the go and no-go decisions are made. From the innovation management perspective this means identifying the most valuable ideas, while the risk management aims to control the process by filtering the elements with higher risk level or those prone to negative result. Management action utilises the information gathered from the previous steps and forms justified decisions on the actions to be taken.

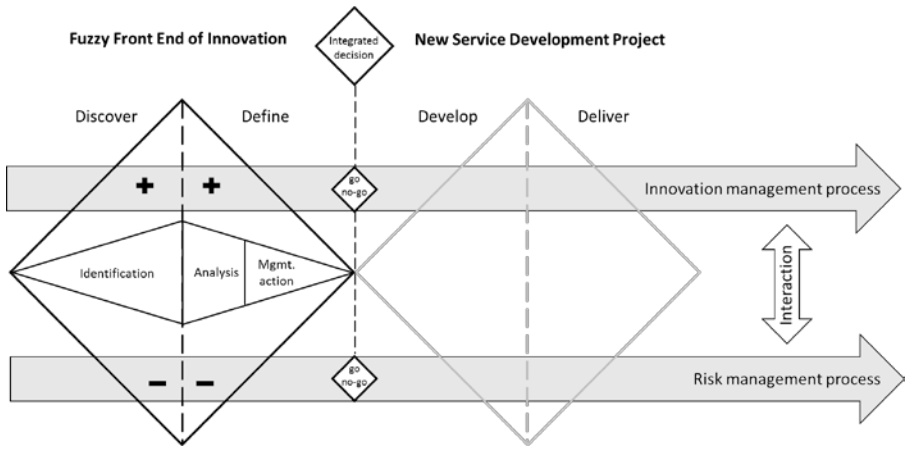


*Figure 1. The double diamond model for integrated FFE innovation and risk management*

## Conclusions

Overall it becomes clear from the available literature that the implementation of risk management in FFE innovation is still in infancy stage. A number of the concepts are still without commonly agreed definition and in many ways the awareness of the subject is still poor. However, risk management can complete the initial steps of innovation management and we believe that there is a need for further contributions in this field.

In this study, we integrated the perspectives of FFE innovation and risk management. The model is derived on the attributes of incremental and radical innovation, however we believe it holds value to connecting innovation with risk management in general. By integrating FFE innovation with perspective of risk management the hindering factors of costs and risks can be taken better into account. As can be noticed from the current literature and our scientometric results, the current perspective of innovation management to risk is narrow and the potential benefits of risk management for example in terms of dealing with uncertainty are mostly overlooked.

The implications of our research are twofold: Firstly, we identify the lack of integrating risk management and innovation management by using the scientometric methodology. Secondly, we put forward a initial model synthesised from the double diamond service design model where FFE innovation management and risk management are integrated. In doing this we aim to instigate the discussion of the important yet sparsely studied field.

This research has obvious limitations due to its explorative design, and further research should be done. The proposed model could be tested empirically and further development in terms of closed investigation of risk, innovation and service attributes should be done.

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